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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/758,637 | 01/14/2004 | Shyam Ramalingam | LAMIP185/P1228 | 5818 |
| 22434 | 7590 | 02/07/2006 | EXAMINER | |
| BEYER WEAVER & THOMAS LLP P.O. BOX 70250 OAKLAND, CA 94612-0250 | | | DEO, DUY VU NGUYEN | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 1765 | |
| DATE MAILED: 02/07/2006 | | | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/758,637

Applicant(s)

RAMALINGAM ET AL.

Examiner

DuyVu n. Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>9/2/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 3, 4, 11-18, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sha et al. (Plasma Etching Selectivity of ZrO₂ to Si in BCl₃/Cl₂ plasma).

Sha describes a method for etching a high dielectric constant layer such as ZrO₂ (claimed high dielectric constant layer having k of at least 8) over a silicon substrate comprising: placing the silicon substrate into an etch chamber; generating a plasma from BCl₃/Ar/Cl₂ to selectively etch the high-k dielectric layer at etch rate of larger than 70 angstrom/min. Unlike claimed invention, Sha doesn't describe the flow ratios of Ar:BCl₃ and BCl₃:Cl₂ are 2:1-1:2 and 2:1-20:1 respectively. However, he suggests experimentally determining the etching gases percentages (or flow ratios), wherein the gases percentage (or flow ratios) would includes those of the claimed range, to selectively etching the high-k dielectric layer (page 1916, left column, second paragraph; page 1920, right column). This would show that these etching gases are result-effective variables (please also see cited Donnelly below) and therefore, one skilled in the art at the time of the invention would find it obvious to determine the flow ratios through routine experimentation in order to provide optimum gases concentration to provide a highly selectively etching of the high-k dielectric layer with a reasonable expectation of success.

Referring to claims 3, 4, 11, 12, the pressure is 5mTorr and no substrate bias (fig. 3).

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Referring to claim 15, determining the processing parameters to achieve a high selectivity such as claimed 4:1 for etching the high-k dielectric layer with respect to silicon would be obvious to one skilled in the art because it is desired to have a high selectivity etching of the high-k dielectric layer with respect to the silicon layer as taught by Sha.

Referring to claim 18, even though Sha doesn't describe other steps such as forming and etching a feature into the poly layer by using a mask and performing an ion implantation into the exposed substrate. However, he describes the method for etching the high-k in the process of forming a MOSFET device, which typically includes those above steps (please see cited Donnelly, Jr. et al. below). Therefore, one skilled in the art would perform those well known steps in order to form a MOSFET device.

3. Claims 2, 5-10, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sha as applied to claims 1, 4, 18 above, and further in view of Kumar et al. (US 2004/0209468 A1).

Referring to the limitations of having processing wafer T below 150 degrees C and 700 watts of power to energize the etchant gas, Kumar teaches processing wafer T such as 20-80 degrees C and a coupled power of 1100 W (paragraphs [0040, 0049]). One skilled in the art would find it obvious to provide the wafer T and coupled power in light of Kumar's teaching of the wafer T and coupled power, because Kumar further teaches processing parameters that are silent in Sha in order to etch the high-k dielectric layer with a reasonable expectation of success.

Donnelly, Jr. et al. ; col., 1, line 38-50 ; col. 4, line 29-55 ; col. 5, line 20-30, col. 6, line 43-60, is cited to show prior art.

Response to Arguments

4. Applicant's arguments filed 11/29/05 have been fully considered but they are not persuasive.

Applicant's argument that Sha doesn't describe the claimed flow ratios is acknowledged. However, he suggests experimentally determining the etching gases percentages (or flow ratios) to selectively etching the high-k dielectric layer (page 1916, left column, second paragraph; page 1920, right column). This would show that these etching gases are result-effective variables (please also see cited Donnelly above) and therefore, one skilled in the art at the time of the invention would find it obvious to determine the flow ratios through routine experimentation in order to provide optimum gases concentration to provide a highly selectively etching of the high-k dielectric layer with a reasonable expectation of success.

Referring to applicant's argument that Sha teaching of pure BCl₃ plasma provide the highest etch selectivity, which teaches away from the recited flow ranges is found unpersuasive because this is not a teaching away but a way of etching the high-k.

Applicant's argument that Sha doesn't point to the probability of successfully achieving the etch selectivity achieved by the recited flow ratios is found unpersuasive because the claims (except claims 8 and 15) do not specify any value for the selectivity or etching ratio between the high-k and the silicon substrate.

Referring to claims 8 and 15, having a higher selectivity for etching the high-k would be desired by one skilled in the art as suggested by Sha above. Furthermore, with Sha's teaching of experimentally determining the etching gases percentages (or flow ratios) to selectively etching the high-k dielectric layer (page 1916, left column, second paragraph; page 1920, right column),

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the flow rates would be result-effective variables. Therefore, determining the flow rates of etching gas through routine experimentation would be obvious to one skilled in the art to achieve the expected high selectivity etching of the high-k.

Information Disclosure Statement

5. The information disclosure statement filed 9/2/05 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

There are no copies, of the foreign patent and non-patent documents listed in the IDS, provided.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-2:30 Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner
Duy-Vu N. Deo
2/2/06

